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BREEDING OF ANOPHELES QUADRIMACULATUS IN DEEP WATER AND AT A DISTANCE FROM SHORE.

By H. R. CARTER, Assistant Surgeon General, United Statse Public Health Service.

It is generally stated that Anopheles do not breed in deep water or at a distance from shore. This is usually true because (1) such water does not furnish food for the larvæ: (2) they are drowned by wave action; and (3) they are eaten by fish.

In the course of malaria surveys made by the United States Public Health Service near the United States Marine Barracks, Quantico, Va., in September, 1917, the contrary was found to be true.

Examination up to July 29 had shown no production of Anopheles in either Quantico or Chappawampsic Creek and no production of *A. quadrimaculatus* anywhere except in pools near the mouth of Creek No. 1. Since this was scanty and had not been found up to July 16, it was feared that this species would appear in Quantico and Chappawampsic Creeks as the season advanced. Being large, these creeks would warm up more slowly and hence breed later than small pools, and this species is not an early breeder.

On September 3 an examination was made of a number of houses at Quantico and *A. quadrimaculatus* were found in them in such number and distribution as to indicate an important source to the northeast of the village. In addition 442 mosquitoes were taken in an isolated group of tents one-third mile distant from the lower part of the Chappawampsic. No other water not under control was within a mile.

Examination of Quantico and Chappawampsic Creeks was made by boat by Mr. Messer of the Virginia State Board of Health and myself. In both creeks there were large masses, acres in extent, of "floatage" over the wild celery (*Vallisneria spiralis*).

This plant was growing in water from 2½ feet to over 6 feet deep and extended in places from one-quarter to possibly one-half mile from shore. Its long blades floated just level with the surface of the water rising and falling with the tide and pointing down the current. The "floatage" was formed mainly of the broken pieces of these blades—they are quite fragile—and an enormous amount of pollen of the same plant; it was then in flower. In a few places the "floatage" was bound together by a growth of algæ, but mainly adherent without it. In these creeks there was the heaviest breeding of *Anophelas quadrimaculatus* I have ever seen over a large area. The patches of "floatage" were measurable in acres and fractions of an acre rather than in square yards. In Quantico Creek they were at both sides of the channel, but none within 300 feet, say, of the shore. In Chappawampsic Creek they were mainly near the mouth and on the side next to the camp. Here they were within half a mile, maybe less, of the tents in which we found the Anopheles and were most probably their source. Quantico Creek is about a mile wide where this "floatage" was found. Chappawampsic is about 1¾ or 2 miles wide at its mouth. We estimated the average number of larvæ per dip at 8, but one dipper took 52. They were of all sizes, and pupæ were also present. In addition to the breeding in this "floatage" there was breeding in some of the lotus beds, where the leaves of this plant fell into the water and adhered together as they decayed. Where the leaf stood up above the water there was no breeding. The same conditions, breeding in floatage in deep water, had been noted on Broad River, S. C., and other places in our work on Impounded Waters, but none so spectacular as this.

In all of these cases the matting of the "floatage" prevented the breaking of the waves, which passed through it in long smooth swells, and furnished a perfect protection against fish. It must also have provided a good food supply.

The problem of the control of this breeding is a very difficult one.

EFFECT OF ANOPHELES PUNCTIPENNIS ON THE NATURAL CONVEYANCE OF MALARIAL FEVER.

By H. R. CARTER, Assistant Surgeon General, United States Public Health Service.

There is no question that *A. punctipennis* is capable of conveying malarial fever. King first (1915) showed that mosquitoes of this species were readily infectible and that the malaria parasite underwent complete sporogenous development in them. Mitzmain later (1916) produced malarial fever in men by the bites of infected mosquitoes of this species. To what extent they convey malaria *in nature*, however, is not determined.

It has been shown (Public Health Bulletin No. 79) that this mosquito is rarely found in residences—houses occupied by men—in the day time. Where both species are breeding to the same extent *A. quadrimaculatus* is found in such houses in far greater numbers than *A. punctipennis*. If this is because *A. punctipennis* do not enter the